DETERMINATION OF FUNCTIONAL PROPERTIES OF FRESH AND POWDERED WHOLE EGG

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ABSTRACT

The study was carried out to determine functional properties of fresh and powdered whole egg. The experiment was carried out at Animal Product and Processing laboratory of the Department Animal Science Federal University Dutsin-Ma. Fresh eggs from laying birds were collect from the Departmental farm. 10eggs each were weighed and crushed into stainless dish and sun dried. After 8 hours of sun drying, the crystals were converted into powder form using grinding and sieving techniques. Samples of the powder whole egg and fresh whole egg were then subjected to functional properties determination. Data from the experiments were subjected to analysis of variance using general linear model procedure of Significant means were separated using Duncan Multiple Range Test (DMRT). The result indicates that fresh whole egg forming capacity (FC) and forming stability (FS) are significant ($P<0.05$) with values of 13.33% and 5.00% while whole egg powder had a value of 6.26% and 2.11%. Similarly Emulsification capacity (EC) and Water Absorption Capacity (WAC) of whole egg powdered were highly significant with values 25.54% and 6.00% while the Emulsification capacity (EC) and Water Absorption Capacity (WAC) fresh whole egg recorded a lower values ($P<0.05$) of 5.93% and 1.33%. The emulsification stability (ES) and Swelling Capacity SC had no significant difference in both fresh and powdered whole egg. The function properties of both fresh and powdered whole egg are mostly similar with only few differences which are attributed to the state of matter. Hence both can be tested for same functional utilization and acceptability in product production and further research should be carried out on the influence of heat on the whole egg nutritional content.

Key words: Sun drying, Powdered, Fresh Egg, Albumin, Yolk, Whole egg.

INTRODUCTION

Whole eggs are basic food material that is always in demand and consumed world-wide. Eggs are effective animal proteins with a potential to contribute to food and nutrition security and generate household livelihoods (Lannotti *et al.,* 2014). It has a considerable place in food industry. Eggs from chicken species provide a balance source of nutrients as it is cheap, affordable and also acceptable. It has characteristics that make it valuable foodstuff as they are highly nutritive and are excellent sources of animal protein for the populace. Egg products include hard-cooked chopped eggs, precooked scrambled eggs or omelets, quiches, precooked egg patties, Scrambled egg mixes crepes (Froming, 2008) and egg powder. In the United State of America about 30% of eggs are processed into various egg products (liquid frozen and dried egg products) for use in the food service industry or as ingredients in various food applications. Comparative advantages egg power has over fresh eggs include longer shelf-life and easy transportation. Fresh whole eggs are however, difficult to transport because of their bulkiness, fragility and highly perishable nature (Frazier and Westhoff, 1988; Jay, 2000). Development and research in food diversity brings to light the importance of food ingredients especially powered food. At the industrial level, eggs are preserved by processing them through spray drying into egg powder (Dixit *et al.,* 2010; Kumaravel *et al.,* 2012; Rannou *et al.,* 2013). The production of dried foods has been on the increase in recent years. Production of dried powdered product is an important sector for the development of the egg market. In Nigeria, it is estimated that more than 90% of the populace live below the poverty level or less than a Dollar per day (Elments Communication, 2007) with few people consuming eggs or egg products. In Nigeria there is a cyclical egg glut in some areas, which might be on the increase as more individuals embark on poultry production in order to alleviate poverty and unemployment. This cyclical egg glut spans for a

minimum of 4-5 months per year. To maximize income, an egg farmer must ensure that his maximum supply of egg coincides with the minimum supply of egg from local sources. With rapid expansion in the poultry industry in Nigeria, it is very easy to go from a deficit to a surplus supply as government policies inject large amounts of capital into poultry production, it would be easy for farmers to be producing these eggs and go bankrupt as a result of market forces and lack of basic storage and processing facilities. Another problem associated with Fresh eggs is however, difficult to transport because of their bulkiness, fragility and highly perishable nature (Frazier and Westerhoff, 1988; Jay, 2000). Transporting eggs in powder form will provides a near complete solution to these problems. Therefore, the determination of whole egg powder functional properties in comparison with fresh whole egg will assist in providing information on whole egg powder when made available and determine if there is deviation from that of fresh whole egg.

MATERIALS AND METHODS

The experiment was carried out at Animal Product and Processing laboratory of the Department Animal Science Federal University Dutsin-Ma.. Dutsin-Ma is located in the North-western Nigeria at Latitude 12^{o}27`18` North and 7^{o}29`29` East and 605 meters above sea level with an average annual rainfall of 750mm.

Data collection

Egg powder was made using Sun techniques. Freshly laid egg from Isa brown layers 3hours of laid were collected from the departmental farm. Samples of 10Eggs each were weighed and crushed into stainless dish for sun drying. The dry crystals were ground into powder. Samples of sun dried whole egg where weigh and determine using digital scale and that of the Fresh egg which are then subjected to functional properties determination.

Determination of Functional properties

The emulsifying activity (EA) and stabilities (ES) were determined using the method of Yasumatsu *et al.*, (1972). One (1g) sample, 10ml distilled water and 10ml soya bean oil was prepared in calibrated centrifuge tube. The emulsion was centrifuged at 2000xg for 5minutes. The ratio of the height of the mixture were calculated as emulsion activity in percentage. The contained calibrated centrifuged tube at 80^{o}C for 30min in a water-bath, cooling for 15min under running tap water and centrifuging at 200xg for 15min. the emulsion stability expressed as percentage was calculated as the ratio of the height of emulsified layer to the total height of the mixture. Foaming Capacities (FC) and Stabilities (FS) using the method of Coffman and Garcia (1997); Narayana and Narsinga Roa, (1982) was determine as described with slight modification. 1g powdered egg sample was added to 50ml distilled water at 30±2 ^{o}C in a graduated cylinder. The suspension was mixed and shaken for 5min to foam. The volume foam at 30s after whipping will be expressed as foam capacity using the formula:

Foaming Capacity= Volume of foam AW-Volume of foam BW/Volume of foam BW

Where, AW= after whipping, BW= before whipping.

The volume of foam was recorded 1hour after whipping to determine foam stability as percent of initial foam volume. The water absorption capacity (WAC) and oil absorption capacities (OAC) were determined using the method of Sosulki *et al.,* (1976). WAC was determine by 1g of sample mixed with 10ml distilled water and allow to stand at ambient temperature (30±2^{o}C) for 30min, the centrifuged for 30min at 3000rpm or 2000xg. Water absorption was examined as per cent water bound per gram powdered egg. While oil absorption capacity was also determine by 1g of sample mix with 10ml soya bean oil (Specific gravity: 0.9092) and allow to stand at ambient temperature (30±2^{o}C) for 30min, the centrifuged for 30min at 300rpm or 200xg. Oil absorption was examined as percent oil bound per gram powdered egg. Swelling capacity (SC) were determined by method described by Coffman and Garcia, (1997); Okaka and Potter (1977) method were 100ml graduated cylinder was filled with the sample to 10ml mark. The distilled water was added to give a total volume of 50ml. the top of the graduated cylinder was tightly covered and mix by inverting the cylinder. The suspension was inverted again after 2min and left to stand for a further 8min. the volume occupied by the sample was taken after the 8thmin.

Data Analysis

Data from the experiments were subjected to analysis of variance using general linear model procedure of SAS (2000). Significant means were separated using Duncan Multiple Range Test (DMRT) according to the procedure described by steel and Torrie (1980).

RESULTS AND DISCUSSION.

Functional properties of fresh and powdered whole egg

The result in Table 1 Shows that the functional properties of fresh and powdered Whole egg. FC, FS, EC and WAC are significant difference from FC, FS and EC powdered egg yolk ($P \leq 0.05$), while EC, WAC and SC of fresh and powdered yolk differs ($P<0.05$) significantly.

Table 1. The functional properties of fresh and powdered whole Egg

Parameters	Fresh	Powdered	SE
FC	13.33a	6.26b	1.28
FS	5.00a	2.11b	0.18
EC	5.93b	25.54a	1.91
ES	1.38	1.78	0.40
WAC	1.33b	6.00a	0.33
SC	1.60	2.66	0.14

[ab]= means with different superscript differed significantly,

SE= Standard error,

FC= Foaming capacity, FS= Foaming stability, EC= Emulsification capacity, ES= Emulsification stability, WAC= Water absorption capacity, SC= Swelling capacity.

The result revealed that Fresh whole egg differs significantly from the powdered whole egg in terms of FC, FS with values ($P<0.05$) of 13.33% and 5.00% for fresh whole egg and 6.26% and 2.11% for whole egg powder. Similarly EC and WAC powdered whole egg were highly significant with values 25,54% and 6.00% while the EC and WAC fresh whole egg recorded a lower values ($P<0.05$) of 5.93% and 1.33%. This may be as a result of the changes in the state of mater from liquid to solid and then to liquid again. The changes do have effect on the physical attributes of egg just a reported by Potter and Hotchkiss 2006 who reported level of denaturation do affects the solubility index which is a physical attributes of protein. Also the ES and SC had no significant difference in both fresh and powdered whole egg.

CONCLUSION AND RECOMMENDATION:

The function property of both fresh and powdered whole egg differs, but can be tested for same functional utilization and acceptability in product production. Further research should be carried out on the influence of heat on the whole egg nutritional content.

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